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Drop-Out Ceiling Panels – A Discussion On Their Use With Fire Sprinklers

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This White Paper is intended to be used as an introduction to those considering the use of drop-out ceiling panels, sometimes referred to as tiles. They have many useful applications as described in the paragraph below where their "drop-out" feature from a standard T bar ceiling grid offers advantages over the commonly used acoustic ceiling tile. They are especially useful when used with fire sprinklers. This paper is a resource and is intended to educate potential users as to the best applications for drop-out panels. It is not intended to be a substitute for checking the applicable listings, codes and standards and encourages users to consult with their authorities having jurisdiction. Authority Having Jurisdiction is abbreviated as AHJ and refers to building officials, fire code officials and in some instances, insurers.

Advantages, Codes and Standards

Approved drop-out ceiling panels can be installed *beneath* fire sprinklers. When exposed to heat from a developing fire, drop-out ceiling panels soften, distort, and fall from the ceiling grid. Heat from the growing fire activates the sprinkler which, unimpeded by the panels, controls or extinguishes the fire.

Drop-out ceilings have several significant advantages:

1. They offer a visually uncluttered appearance.

2. They provide protection for the sprinklers – making them less prone to accidental knocks and potential water damage.

3. They simplify sprinkler design at clouds and other design features as the sprinklers are located above the dropped ceiling.

4. They're cost effective as they eliminate the need to "drop" (lower) the sprinklers and allow for the use of less costly, non-appearance grade sprinklers.

Use of drop-out ceiling panels is governed by the local building and fire codes, which address acceptable interior finish elements like ceiling panels. The International Building Code (IBC) is often used as the model building code from which many building codes are based. The IBC covers interior finish elements like ceiling panels in Chapter 8 and addresses fire sprinklers in Chapter 9. When requiring fire sprinkler systems, the code refers to National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems.* That standard addresses drop-out ceilings in Section 8.15.15 (2013 Edition), permitting their installation beneath sprinklers where ceilings are listed and installed for that service. In a similar way, NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies,* permits drop-out ceilings in Section 6.15.

NFPA does not approve, inspect, or certify drop-out ceiling panels; nor does it approve testing laboratories. The Authority Having Jurisdiction refers to listings of an organization that is concerned with product evaluations to determine compliance with appropriate standards. Details are available in an evaluation report prepared by a recognized independent listing agency, such as IAPMO, ICC-ES, FM Global, UL, and CertMark. Links to these reports are included at the end of this discussion. Of course, the Building Official and / or Fire Code Official have the final approval authority. It is well to contact these authorities early in the design to get their input, answer their questions and address any concerns.

Occupancy

In general, the design of a drop-out ceiling system begins with identification of the building occupancy. Approved drop-out panels are currently available that have been evaluated for use in areas classified as Light Hazard and Ordinary Hazard, Group 1. Factory Mutual approves drop-out ceiling panels for use in Light Hazard Occupancies. Reports by other agencies allow for use of ceiling panels in Ordinary Hazard Group 1 occupancies. Always check the product evaluation report to confirm where the ceiling panel may be used. In addition, confirm the agency is acceptable to your AHJ. Light Hazard Occupancies are where combustibility and / or quantity of contents is low and fires with relatively low heat release are expected. Ordinary Hazard Group 1 Occupancies are where combustibility is low and the quantity of combustibles is moderate, stockpiles don't exceed 8 feet and fires with moderate rates of heat release are expected. Attached with this white paper is an Application Table for Drop-out Ceiling Panels. It provides examples of typical occupancies where the use of these panels is either appropriate or inappropriate.

Sprinkler Types

Next is selection of sprinkler types. All drop-out panels currently available have been evaluated for use with SR (standard-response) sprinklers. Standard-response sprinklers are a type of spray sprinkler that has a thermal element with an RTI (Response Time Index, a measure of thermal sensitivity) of more than 50 $(\text{meter-seconds})^{1/2}$. One drop-out panel has been recently listed for use with QR (quick-response) sprinklers (see IAPMO Evaluation Report No. 0310 valid through 11/2014). This is a significant development as quick-response sprinklers have been required in Light Hazard Occupancies since the 1996 edition of NFPA 13. Quick-response sprinklers have an RTI of 50 $(\text{meter-seconds})^{1/2}$ or less. Currently, no drop-out panels have been tested with other types of sprinklers, such as extended coverage, residential and dry-pipe sprinkler systems. Factory Mutual's Data Sheet 1-12 and IAPMO Evaluation Report 0310 both prohibit the use of drop-out ceiling panels with dry-pipe sprinklers.

Evaluation Reports specify allowable sprinkler heights above the ceiling panels and require identification of the report on packaging. Examples are:

1. A 0.013-inch thick vinyl drop-out panel listed for use with quick-response sprinklers rated at 155°F or higher requires that the sprinkler be installed 1-inch or less from the top of ceiling grid.

2. Standard-response sprinklers rated 165°F or higher can be installed from 1-inch to 60 inches above the ceiling panels. Sprinklers must be installed in compliance with all of the NFPA 13 (or 13R) requirements, including obstructions with structural elements, HVAC ducts, and other above-ceiling elements.

3. Prior to installation, verify that packages are marked with evaluation report and appropriate agency listing numbers.

Inappropriate Applications

Finally, check for the following conditions, as any of them will preclude the use of drop-out ceilings:

1. Use is prohibited in exits such as corridors, stairways, horizontal exits, pressurized enclosures and exit passageways as defined in Chapter 10 of the IBC. A copy of the Chapter 10 definitions is listed at the end of this discussion.

2. Where sprinklers are installed below panels.

3. Where insulation is located between ceiling panels and sprinklers (exception: insulating panel arrangement as mentioned in the specific ceiling panel listing)

4. Based on current listings, any drop-out panels that are not Class A rated (flame spread index of less than 25 and a smoke developed index of less than 450), would be prohibited in some locations based on Chapter 8 of the IBC.

5. Where piping is required to be concealed (e.g. soft-soldered copper pipe or combustible plastic pipe). A drop-out ceiling is not considered to provide concealment, as it will drop early in a fire. Acoustical (mineral fiber) tiles are usually considered to provide the required level of concealment, as they do not drop in the event of being exposed to temperatures above 165°F.

6. Where the ceiling is required to be a part of fire-resistance rated assembly. Note that drop-out ceilings can be installed below a rated assembly, they just can't be a part of that assembly.

7. Where the space above the panels is used as an air circulation plenum

8. Ceiling is non-horizontal, including ceilings on floating, waterborne structures, as they have not been tested.

9. Where the suspended ceiling system is not the 1-inch nominal (15/16-inch) face grid system or the system is not in compliance with Building Code requirements. Specialty systems, such as Slim Line or Concealed Grid, have not been tested for use with drop-out ceilings.

10. Clips that prevent downward movement of the panel. Uplift prevention clips are permitted but not required. Be sure to follow the requirements of the ceiling panel's appropriate approval / listing document.

The following Application Table helps quickly identify those applications where drop-out ceiling panels should be considered and those applications where they would be inappropriate. The table is not meant to be definitive but rather illustrative, as occupancies can vary significantly.

Consider these two examples:
***A dairy processing facility, in its typical configuration, would offer an appropriate application for drop-out ceiling panels. However, if that same facility incorporated significant quantities of cardboard packaging stored in piles more than 8 feet high, it would not be an appropriate application.

***Mercantile operations, in their typical configuration, are considered to be Ordinary Hazard Group II occupancies, and are therefore not appropriate for drop-out ceiling panels. Yet in some jurisdictions for operations like a pottery store, where the combustibility of the contents is low, the quantity of combustibles is moderate, and stockpiles don't exceed 8 feet, the use of drop-out ceiling panels might be appropriate and acceptable to the AHJ.

Notes

1. Light-transmitting plastics are regulated by the Building Code, typically in Chapter 26. When drop-out ceiling panels are used in illuminated ceiling applications be sure to consult with the AHJ (often the Building Official) relative to your specific use. Drop-out ceiling panels must never be used as diffusers within light fixtures.

2. The building owner must maintain their sprinkler and ceiling systems. Replace drop-out ceiling panels in kind, just like you would a sprinkler. Drop-out panels beneath sprinklers cannot be painted. Some drop-out ceiling panel manufacturers offer signage reminding users to replace panels in kind. This signage can be posted at the sprinkler control valve (next to the hydraulic nameplate).

Definitions from the 2012 IBC*

EXIT – That portion of a means of egress system between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of exit discharge, interior exit stairways, interior exit ramps, exit passageways, exterior exit stairways and exterior exit ramps and horizontal exits.

CORRIDOR – An enclosed exit access component that defines and provides a path of egress travel.

STAIRWAY – One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

EXIT, HORIZONTAL – A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

EXIT PASSAGEWAY – An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an exit or to the exit discharge.

* ***Definitions: Exit; Corridor; Stairway; Exit, Horizontal; Exit Passageway. Excerpted from the 2012 International Building Code; Copyright 2011. Washington, D.C.; International Code Council. Reproduced with permission. All rights reserved. www.ICCSAFE.org***

Links:

Links with a bold title are directly to the third party agencies site, those links without a bold title are to a site hosted by the respective manufacturer:

UL - Ceiling Panels for Use beneath Sprinklers

http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/showpage.html?&name=BLME.GuideInfo&ccnshorttitle=Ceiling+Panels+for+Use+Beneath+Sprinklers&objid=1074290978&cfgid=1073741824&version=versionless&parent_id=1073984637&sequence=1

IAPMO

http://www.iapmoes.org/Documents/ER_0310.pdf

CertMark

http://certmark.org/certificates/Empire-West/CER-3101.pdf

FM Approvals

FM Test Standard:

http://www.fmglobal.com/assets/pdf/fmapprovals/4651.pdf

FM Log In Link:

http://www.approvalguide.com/CC_host/pages/custom/templates/FM/index.cfm?line=3820&searchtype=product&keywords=drop%20out%20panel

Manufacturer's listing:

http://www.ceilume.com/static/pdfs/ul.pdf

http://www.ceilume.com/staticShared/pdfs/fm.pdf

DROP-OUT CEILING PANELS WITH SPRINKLERS – APPLICATION TABLE

	CURRENTLY APPROPRIATE	NOT CURRENTLY APPROPRIATE
Product:	Meets IBC Section 803. Recognized as approved by agencies such as IAPMO, ICC, CertMark, UL, Factory Mutual-(FM recognizes Light Hazard occupancy use only)	Not compliant with IBC Section 803. Not recognized by independent, accredited third-party evaluation agencies.
Occupancy:	As defined by NFPA 13: Light Hazard Ordinary Hazard Group 1	Ordinary Hazard Group II Extra Hazard Group I Extra Hazard II Special hazards
Sprinklers:	Quick-Response *155°F or higher Standard-Response 165°F or higher	Extended coverage Quick-response less than 155°F Standard-response less than 165°F Use with Residential Sprinkler Dry Pipe Systems
Installation:	Horizontal orientation only Code compliant suspension system 1" (15/16") face grid Sprinklers above panels. Uplift prevention clips allowed	Sloped ceilings (including ships) Part of fire rated assembly Space above used as air plenum. 165 °F sprinkler > 5ft. from panel 155 °F sprinkler > 1-inch from grid. Sprinklers installed below panels Insulation between panels and sprinkler Clips that would hinder panel's ability to drop Material affected by high temp is required by code to be "concealed" by ceiling Exits**
Sprinklered Occupancy Examples:	Reference NFPA 13, Annex 5.2 through 5.4 ***Light Hazard*** Animal shelters Churches Clubs Kennels Libraries (except large stack) Museums Offices, including data processing Restaurants seating areas Theaters/auditoriums, excluding stages ***Ordinary Hazard Group 1*** Auto showrooms Bakeries & Laundries Canneries Dairy products manufacturing/processing Electronic Plants	Chemical plants Distilleries Machine shops Auto repair Stages (theatre) Paper processing Residential (see Notes below) Mercantile (see Notes below) Manufacturing Combustible Saw mills Flammable liquids Solvent cleaning

* Currently only one listed

** See White Paper section on Sprinkler Types

NOTES

Occupancy

Light Hazard occupancies are appropriate for the use of drop-out ceiling panels due to the low quantity and / or combustibility of their contents and the expected low heat release rate fires. Some examples of occupancies having uses and conditions consistent with Light Hazard are most movie theaters, bowling alleys, pool parlors, roller rinks, swim centers, gyms, and work out facilities.

A number of types of light manufacturing facilities might be appropriate to consider for drop-out panels as they would be similar to electronic plants. NFPA 13 deems such plants as Ordinary Hazard Group 1 and would allow the use of drop-out ceiling panels (FM only allows the use of drop-out ceiling panels with Light Hazard occupancies). However, many manufacturing facilities such as plastics fabrication, wood machining, and machine shops are classified as Ordinary Hazard Group 2 and would not be appropriate for drop-out panels. Key concerns to avoid when considering drop-out panels are stockpiles of combustibles over 8 feet high, stockpiles of contents with high rates of heat release, or the probability of rapidly developing fires.

Mercantile Occupancies are classified in NFPA 13 as being Ordinary Hazard Group 2 and are defined as those occupancies used for *"the display and sale of merchandise"*. This is a very broad definition that, on its face, would appear to make the use of drop-out ceiling tiles inappropriate for **all** operations that display and sell merchandise. That is clearly not its intent (see the pottery store example above). The intent is to prohibit use of drop-out ceiling tiles where combustibility, quantity, and storage height of fuel is higher than that allowed in Ordinary Hazard Group 1 occupancies. When researching your specific application, it is helpful to locate your fire sprinkler riser and check its hydraulic nameplate data. It should list the occupancy classification. This information may be helpful in determining if the area in question is Light Hazard, Ordinary Hazard Group 1, Group 2, Extra Hazard Group 1, Group 2 or Special Hazard. Check with your AHJ and be ready to provide this nameplate information as it may help them in determining your occupancy and whether a drop-out ceiling panel is appropriate.

Residential

Following NFPA 13 and 13R, drop-out ceilings are permitted in residential occupancies. Drop-out ceilings can be used in those applications having standard-response, 165°F sprinklers. Where the sprinkler protection involves quick-response sprinklers, there is one drop-out ceiling panel listed for use with 155°F or higher quick-response sprinklers. Currently, there are no drop-out ceiling panels tested or listed for use with residential sprinklers.

Note: Certain drop-out panels have Evaluation Reports by accredited third party agencies that follow NFPA 13 standards, and recognize the use of those panels in both Light Hazard and Ordinary Hazard Group 1 occupancies. If the drop-out ceiling panel you are considering **only** has an FM Approval, then those panels can only be used in Light Hazard occupancies, and any FM limitation should be applied to their use. These limitations also apply where FM standards are being enforced for insurance purposes or as a condition of approval by the building/fire code AHJ.

Top Ten FAQ'S For Drop-out Ceiling Panels

The following are frequently asked questions (FAQ's) regarding the use of drop-out ceiling panels.

#1
Q: Will panels be dropping onto occupants or firefighters in the event of a fire?

A: No. This is extremely unlikely to occur as panels drop-out quickly in the presence of heat from a fire. They drop at a temperature of about 165^{o}F which is too hot for occupants and which will be exceeded well before firefighters are on the scene.

#2
Q: Will water spray from adjacent sprinklers cool panels which have not yet dropped (cold soldering), preventing them from falling and blocking spray from sprinklers above them?

A: No. Panel drop-out function is tested (FM Approvals 4651) by spraying sprinkler water onto the back side of the panels prior to ignition of the heat source. This testing assures that panels drop out even if sprinkler water gets to them before the heat of the fire.

#3
Q: In a large, rapidly accelerating fire, will panels ignite before dropping from the grid?

A: No. Drop-out ceiling panels are only approved for use in Light Hazard and Ordinary Hazard Group 1 Occupancies, where only fires with moderate rates of heat release are expected. The panel material ignition temperatures are many hundreds of degrees Fahrenheit higher than their drop-out temperatures. The panel should drop out long before ignition temperature is reached.

#4
Q: Will falling panels harm occupants who are injured and cannot self-evacuated, or hamper rescue and fire suppression efforts by firefighters?

A: No. Panels are very light weight, move easily out of the way, and are not allowed for use in restricted areas such as exits, enclosed stairwells and corridors.

#5
Q: Will falling panels become entangled with sprinklers?

A: No. Sprinklers are located above the panels.

#6
Q: Will falling panels add to the fire load?

A: No. Panels are Class A rated materials with low flame spread and smoke developed indexes. Sprinklers are expected to discharge long before panels reach their ignition temperature. As the panels are quite light, their contribution to the overall fuel load is extremely low. As they drop out early in the fire, their location should make them likely to be receiving the cooling spray from flowing sprinklers and unlikely to contribute to the fire load.

#7
Q: Are panels "sticky" when they are on the floor, and do they make the floor slippery?

A: The fire's heat deforms the panels so they will drop from the grid, but it does not melt them. Once on the floor the panels are semi-rigid, are not sticky, and are being cooled by the sprinkler spray---which is making the floor slippery whether or not the panels are there.

#8
Q: Can drop-out panels be used with any type of fire suppression sprinklers?

A: No. Drop-out panels are currently approved for use with standard-response sprinklers having an activation temperature of 165 ^{o}F or above. Check the panel's installation instructions and approvals for specific details. There is one drop-out panel listed for use with quick-response sprinklers having an activation temperature of 155 ^{o}F or above. Currently, there are no drop-out panels approved for use with extended coverage sprinklers, dry pipe sprinklers, quick-response sprinklers having an activation temperature less than 155 ^{o}F or standard-response sprinklers having an activation temperature less than 165 ^{o}F.

#9
Q: Do all panels or tiles marketed as "drop-out" or "melt out" tiles qualify for drop-out installation?

A: No. In order for panels to be acceptable, products must be tested, approved and recognized by accredited third party agencies specifically for drop-out use. Some panels have no listings or approvals and are therefore unacceptable. The AHJ determines if the third party agency is acceptable.

#10
Q: Because a drop-out panel has a third party product recognition (e.g. IAPMO, ICC, UL, FM, and CertMark), does that mean that a building inspector or fire official must accept its use if the installation complies with the recognition and all applicable codes?

A: No. The local Authority Having Jurisdiction (AHJ) always has the final say with any building product, so it is always recommended to check with them before proceeding.